147-4.

A. I. A. File Number 3b

MAR 3 '26

CELITE PRODUCTS COMPANY

NEW YORK – 11 BROADWAY. CHICAGO – 53 W. JACKSON BLVD.
LOS ANGELES – 1320 SO. HOPE ST. SAN FRANCISCO – MONADNOCK BLDG.

OFFICES AND WAREHOUSES IN PRINCIPAL CITIES

CELITE PRODUCTS LIMITED, New Birks Bldg., Montreal, Canada
CELITE PRODUCTS CORPORATION, 147 Windsor House, Westminster, London, Eng.

BULLETIN 314

BARRIERS TO INDUSTRIAL WASTE
FILTER-CEL
SUPER-CEL
BIL-O-CEL
CELITE

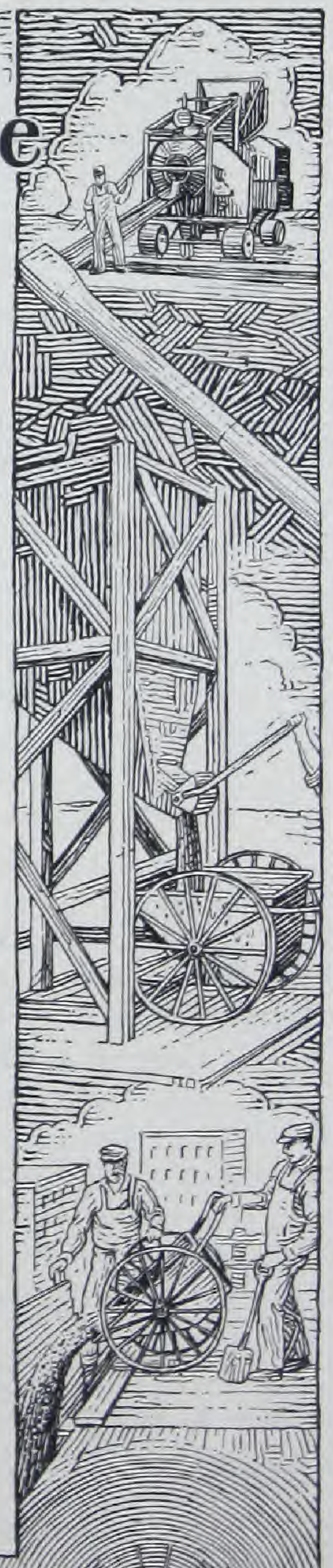
CELITE
An Admixture for Concrete

CHANGES in theory and practice have not affected the demand for suitable admixtures. Developments within the past few years have definitely established the fact that the addition of small amounts of finely divided silica to Portland cement mixtures is of extremely practical advantage when before this time the theoretical value was overbalanced by the impossibility of securing the desired material in practical form. The marketing of amorphous silica (Celite) has met the demand and provided a valuable tool in the hands of the engineer, architect and contractor.

The use of Celite has allowed the problems encountered in securing economic concrete to be overcome at the source. It is a technical and practical method in one; technical because of the chemical content and extreme fineness of the material, and practical because of its effectiveness in increasing workability when small amounts are used.

We know that a lean concrete mixture is not as easily placed as one rich in cement; we know that certain types of aggregates in concrete are handled better than others. To make all these factors equal in the finished mixture is a problem of workability. Workability is an intrinsic property of concrete and cannot be secured by the use of excess water.

In addition to being the most effective material known for increasing the workability of concrete, Celite is by far the most economical. That *Celite insures better concrete at less cost* has been proved in every type of concrete construction.



A. I. A. File Number 3b

Partial List of Representative Jobs on Which Celite Has Been Used as an Admixture in Concrete

Buildings

Barker Bros. Building, Los Angeles, Calif.
Commercial Club, Los Angeles, Calif.
Elks Club, Los Angeles and Sacramento, Calif.
International Motors Building, Plainfield, N. J.
Methodist Book Co., Dobbs Ferry, N. Y.
New York State Arsenal, Brooklyn, N. Y.
New Pacific Finance Building, Los Angeles, Calif.
Pacific Coast Club, Long Beach, Calif.
Public School No. 131, Jamaica, N. Y.
Southern Pacific R. R. Depot, Sacramento, Calif.
Temple Emanu-El, San Francisco, Calif.
Washington Mutual Savings Bank, Seattle, Wash.
California State Automobile Association Building, San Francisco, Calif.

Dams and Bridges

City of Los Angeles, Cahuenga Pass Highway Retaining Wall.
City of Los Angeles, Macy Street Viaduct.
Great Lakes Naval Training Station, Bridge, North Chicago, Ill.
Great Western Power Co., Lake Almanor Dam, Calif.
North Carolina State Highway Dept., Bridge, Smithfield, N. C.
Van Dusen River Bridges No. 1, 2 and 3, Humboldt County, Calif.

State and Municipal Projects

(Buildings, Pavement, Sewers, Water and Sanitary Plants, Etc.)

City of Elk City (Okla.)
City of LaPlata (Mo.)
City of Los Angeles (Calif.)
City of Louisburg (N. C.)
City of Madison (Wis.)
City of New York (N. Y.)
City of Piedmont (Mo.)
City of Portland (Ore.)
City of Snohomish (Wash.)
City of Springfield (Ill.)
City of Staunton (Ill.)
City of Thomasville (N. C.)
City of Trenton (N. J.)
City of Winston Salem (N. C.)
State of Massachusetts
State of New Jersey
State of New York
State of North Carolina

Industrial Plants and Railroads

Associated Oil Co., Tacoma, Wash., and Emeryville, Calif.
By-Products Coke Corp., Chicago, Ill.
East Bay Water Co., Oakland, Calif.
General Petroleum Co., Watson, Calif.
Illinois Central Railroad (Van Buren St. Terminal), Chicago.
J. M. Lee, Inc., Brooklyn, N. Y.
Midwest Refining Co., Salt Creek, Wyo.
Monsanto Chemical Works, E. St. Louis, Ill.
New York Central Railroad (Underground Cable Line), Yonkers, N. Y.
Olympic-Calpet Refining Co., Seattle, Wash.
Pacific Gas & Electric Co. (Sub-Stations, Tunnels, Power Houses, etc.).
Shell Co. of Calif., Martinez, Calif.
Southern Pacific Railroad (Tunnels, Stations, Snow-sheds, etc.).
Standard Oil Co. of Ind., Casper, Wyo.
Standard Oil Co. of N. J., Newark, N. J.

CELITE
Insures Better Concrete at Less Cost

CELITE

An Admixture for Concrete

THE use of admixtures is simply a means of insuring better concrete under average field conditions. Their use does not imply a revolutionary practice in the use of Portland cement or in the production of concrete, as admixtures have been employed for many years with success.

The effect of finely divided inert siliceous material in promoting workability in concrete has been recognized for some time. This material (diatomaceous silica) is specified abroad as the most valuable admixture for concrete, especially that required to withstand the action of sea water.

Celite, a grade of diatomaceous silica of exceptionally high purity, is now being specified and used in many large projects in the United States by Federal, State, County and Municipal Engineers as well as by many large engineering organizations. It has the endorsement of contractors because of its exceptional effect in producing workability and because of the savings obtained through its use.

The properties of Celite were recognized during the World War in the building of concrete ships and barges by the Emergency Fleet Corporation. Celite, in the ratio of from 2% to 4% by weight of Portland cement, was employed to promote workability in the concrete and aid in its uniform placing around intricate reinforcing. Before this, Celite was employed as an admixture in the construction of a number of large concrete oil storage tanks on the Atlantic Coast. The excellent quality of this concrete is apparent today. Celite is not a new or untried material. Its general advantages have been known by many engineers for years.

Fig. 1. Bridge at Great Lakes Naval Training Station, North Chicago, Illinois. 3% Celite in 1:2:4 Mix.

Engineers knew that better concrete was secured under average field conditions where finely divided admixtures were employed but no data were available to measure their benefits in a quantitative manner. A valuable step in this direction was taken in the interesting series of tests on admixtures in concrete conducted by Messrs. J. C. Pearson and Frank A. Hitchcock at the Bureau of Standards in Washington. The results of this work were described in papers presented by the authors at meetings of The American Society for Testing Materials 1923[1], and the American Concrete Institute 1924[2].

The work of Pearson and Hitchcock dealt largely with the development of a means of measuring the relative workability of various concrete mixtures with varying percentages of admixtures. Relative workability was determined by means of an apparatus devised by the authors and described by them as follows in their paper before the American Concrete Institute 1924.

"The apparatus is shown in Fig. 2 in which M is a 6-inch by 12-inch cylindrical mold with a tight bottom mounted upon a small table which can be raised and dropped about one-tenth of an inch by means of a cam. A spider F is mounted on top of the mold carrying a sleeve S into which a close fitting steel rod about 20 inches long can be introduced in align-

[1]A Penetration Test for the Workability of Concrete Mixtures with Particular Reference to the Effects of Certain Powdered Admixtures.
[2]Economic Value of Admixtures.

ment with the axis of the mold. In our most recent experiments the rod is tapered to a 45°cone on its lower end, and

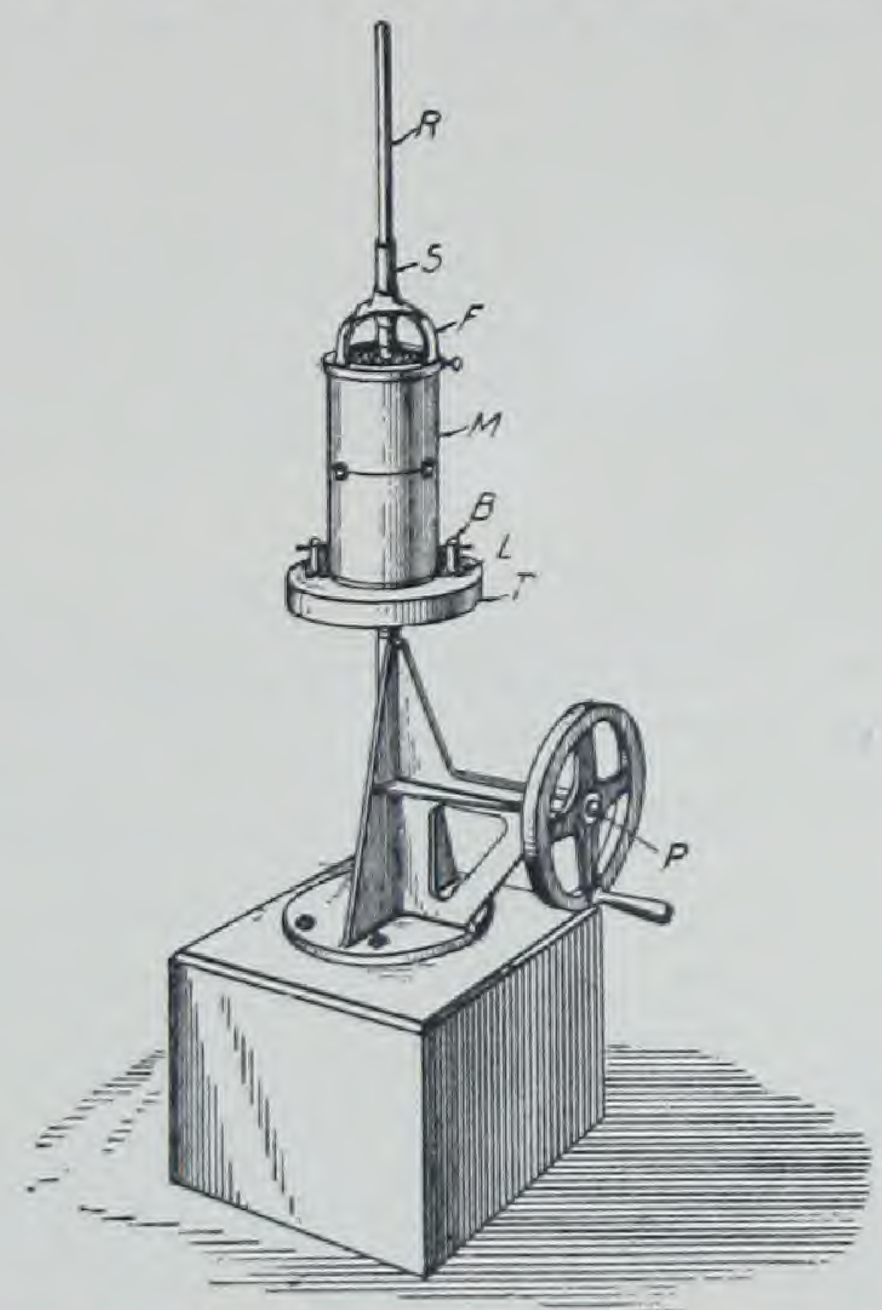


Fig. 2. Penetration Apparatus Used in Workability Tests at U. S. Bureau of Standards.

is graduated in such manner that the depth of the lower end below the top of the mold is read directly.

"The batch of concrete to be tested is placed uniformly in the mold and first compacted by 30 drops of the table, then the rod is inserted in the sleeve and lowered gently into the concrete until it comes to rest under its own weight. The cam shaft is then turned and the mold full of concrete is successively raised and dropped in such manner as to allow a reading on the rod after each impact. The test is regarded as complete when the rod has penetrated the concrete to a depth of 10 inches. From the data of the test a penetration curve is obtained. It is obvious that the richer or more plastic the concrete mixture, the more readily will the rod penetrate to the prescribed depth, and the number of impacts required to cause the rod to reach the 10-inch mark is therefore a rough index of the workability of the mixture. . . .

"These figures have been found to be reliable indices of the workability of concrete mixtures in so far as we are able to judge this quality."

The effect of Celite was summarized in this paper by Messrs. Pearson and Hitchcock as follows:

"The workability of any concrete mixture is about equally benefited by one part of Celite, two parts of kaolin, or three parts of hydrated lime such as used in these tests, if the consistency as measured by the flow table is kept constant."

These investigations paved the way for field tests in various types of concrete work. The information in the following pages describes tests on Celite in various kinds of concrete work and outlines what Celite will accomplish as an admixture in concrete based on actual field operations.

CHEMICAL AND PHYSICAL PROPERTIES

Celite is secured from practically limitless deposits of constant high purity and the milling and manufacturing operations are so closely controlled that the production of material of absolute uniformity is assured at all times. Being composed of practically pure amorphous silica (SiO_2), Celite is a permanent element in concrete and does not affect the time of setting. It has no cementing properties and should not be substituted for cement. It accomplishes the desired purposes in a practical manner because of its light weight, extreme fineness and its ability to promote workability and its attendant advantages through simple, physical means.

HOW CELITE IS USED

Celite is furnished in the form of a lightweight powder in an extremely finely divided state. No changes in equipment or methods of mixing and pouring concrete are necessary in order to use it. Celite is simply added with the other dry materials and the mix is handled in the usual manner. By means of a suitable weighing or volumetric device, the amount of Celite to use per batch can be determined, based on the recommendations for the job at hand.

The quantity of Celite which should be used to secure the best results varies with the mix. In general more Celite is used to advantage in the leaner mixtures although ***in any case the amount of Celite constitutes***

only a very small proportion of the entire mixture. The percentages by weight of cement content which have been found to give the best results are given below:

Concrete Mix	Percentage of Celite Added
1:1½:3	1½-3% by weight of cement
1:2 :4	2 - 4% by weight of cement
1:2½:5	3 - 6% by weight of cement
1:3 :6	4 - 8% by weight of cement

The nature of the aggregate used determines to a large extent the exact quantity of Celite required to secure the greatest degree of workability. For this reason, a range of percentages is indicated above for each given mix. The harsher the aggregate, the more Celite will be required.

ADVANTAGES OF CELITE AS AN ADMIXTURE

Improved Workability

Workability is the most important factor in the manipulation of concrete. Most of the faults found in finished field concrete can be traced directly to lack of workability. Too often the blame is placed on poor materials when the trouble is actually one of workability.

In the past the promotion of workability has generally been attempted by the use of excess mixing water. Investigation proves decisively, however, that the use of excess mixing water not only fails to accomplish this purpose, but decreases the strength of the concrete.

By the use of Celite, concrete of much drier consistency and at the same time one of high workability is assured. The use of Celite results in built-in workability. It greatly increases the plasticity of the mix and holds the ingredients in suspension. It insures uniform distribution of the cement and an even coating of matrix on the coarser aggregate. (NOTE: Because of the greater plasticity imparted to the concrete it is necessary that the forms be thoroughly braced and tied.)

By securing a more workable mixture of drier consistency, other benefits naturally follow:

- Celite insures quicker and cleaner discharge from the mixer.
- The concrete can be placed with less labor and manipulation.
- It will flow into place in the forms around the most intricate reinforcing, filling completely all corners and recesses.
- Relatively dry concrete can be satisfactorily handled by chutes without the need for excess water.
- In cases where central mixing is employed, no segregation will be encountered in transit from the mixer to the job, and difficulties in dumping from trucks will be eliminated.

Uniformity and Strength

Concrete failing is analogous to a chain breaking at its weakest link. By eliminating these weak "links" and securing a uniform concrete, the effective strength of the mass is greatly increased.

Segregation of the aggregate and cement is the cause of lack of uniformity. Most ordinary concrete mixes require an excess amount of water to make them sufficiently fluid to transport and place in the forms without the expenditure of more labor than is practical under ordinary working conditions. The addition of Celite produces a stiff mixture which is easily transported and

Fig. 3. Celite is Added at the Mixer with the other dry Materials.

placed without segregation and with a minimum amount of labor.

The chart shown in Figure 5 illustrates in a graphic manner the greater uniformity of

concrete containing Celite. These tests were made on cores drilled from one of the paving

Fig. 4. Chuting Concrete for Methodist Book Co. Printing Plant, Dobbs Ferry, N. Y.
Visscher & Burley, New York City, Architects. United Fireproofing Co., New York City, Contractors.
3% Celite in 1:2:4 Mix.

projects in North Carolina. It will be noted that the variation in strength of the concrete containing Celite was only 11.1% compared to 17.4% for plain concrete, the variation in the plain concrete being 57% greater than that in which Celite was used. Investigations by several other States check these results very closely. The wide variation in the strength values shown is typical of field concrete. It cannot be laid under the ideal conditions to be found in the laboratory.

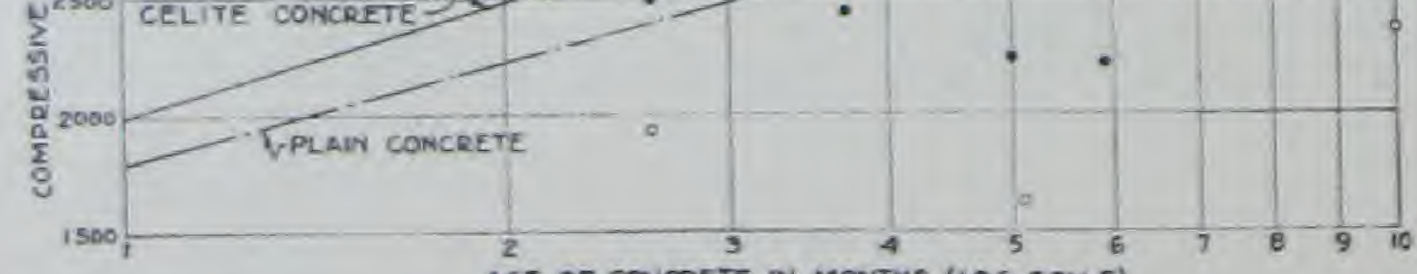


Fig. 5. Comparative Strength of Concrete with and without Celite.

The water absorbed by the Celite in the mix is held by it mechanically which greatly retards evaporation. This is an important advantage, because this mechanically held moisture is drawn on by the Portland cement during the later stages of its hydration after the free water present has evaporated. More complete hydration of the cement is effected in this way and results in a concrete of higher strength.

Water-Tightness

Water-tightness is a requirement in many concrete structures, especially those built to contain liquids or those which may be called upon to resist the passage of liquids through them. It is a highly desirable feature, however, in concrete construction of all types as

Fig. 6. Spray Pond at Monsanto Chemical Works, East St. Louis, Ill. W. D. Spengler, Cleveland, Engineer.
3% Celite in 1:2:4 Mix.

it is evidence of closer texture in the structure which offers a greater resistance to weathering and attack by destructive elements.

With normally graded aggregate, the degree to which a structure is water-tight depends on the uniformity of distribution of the cement, aggregate and voids throughout the mass as well as on the size of the individual voids. A decrease in void size results in breaking up the minute channels through the concrete, thereby blocking them off from each other. The importance of decreasing the size of the voids is illustrated by comparing the water holding capacity of two laboratory sieves of different sized openings. One having four openings per inch will allow water

to pass through it without resistance, while one having two hundred openings per inch, but with over sixty per cent of the open area of the former, will successfully hold water.

The decrease in void size can only be accomplished by the use of a material that is fine enough to fit into the voids and has the property of preventing segregation of the coarse and fine aggregate which otherwise will form large connected voids. The fineness of the material is an important factor in determining its efficiency in this respect. Fine sand, for instance, is more effective in making water-tight concrete than that of coarser gradation. It is necessary, however, to use materials very much finer than sand if the desired results are to be assured and no decrease in strength sustained.

Fig. 7. Pit River No. 3 Tunnel of Pacific Gas & Electric Co. 2½% Celite in 1:2½:3½ Mix.

Celite increases the water-tightness of concrete in two ways: first, by insuring more uniform concrete and a uniform distribution of voids throughout the mass; and second, by decreasing the void size which is a function of the extreme fineness of the material.

Increased Yield

Due to the bulking effect of Celite, its use results in an increased yield of finished concrete in place. This is caused by the light weight and extreme bulkiness of the material and the fact that it "fattens" the mixture. This increase in yield means that the actual cost of Celite concrete in place, with mixes ordinarily employed, is less than that of plain concrete as the cost of the Celite used is more than offset by the additional concrete secured.

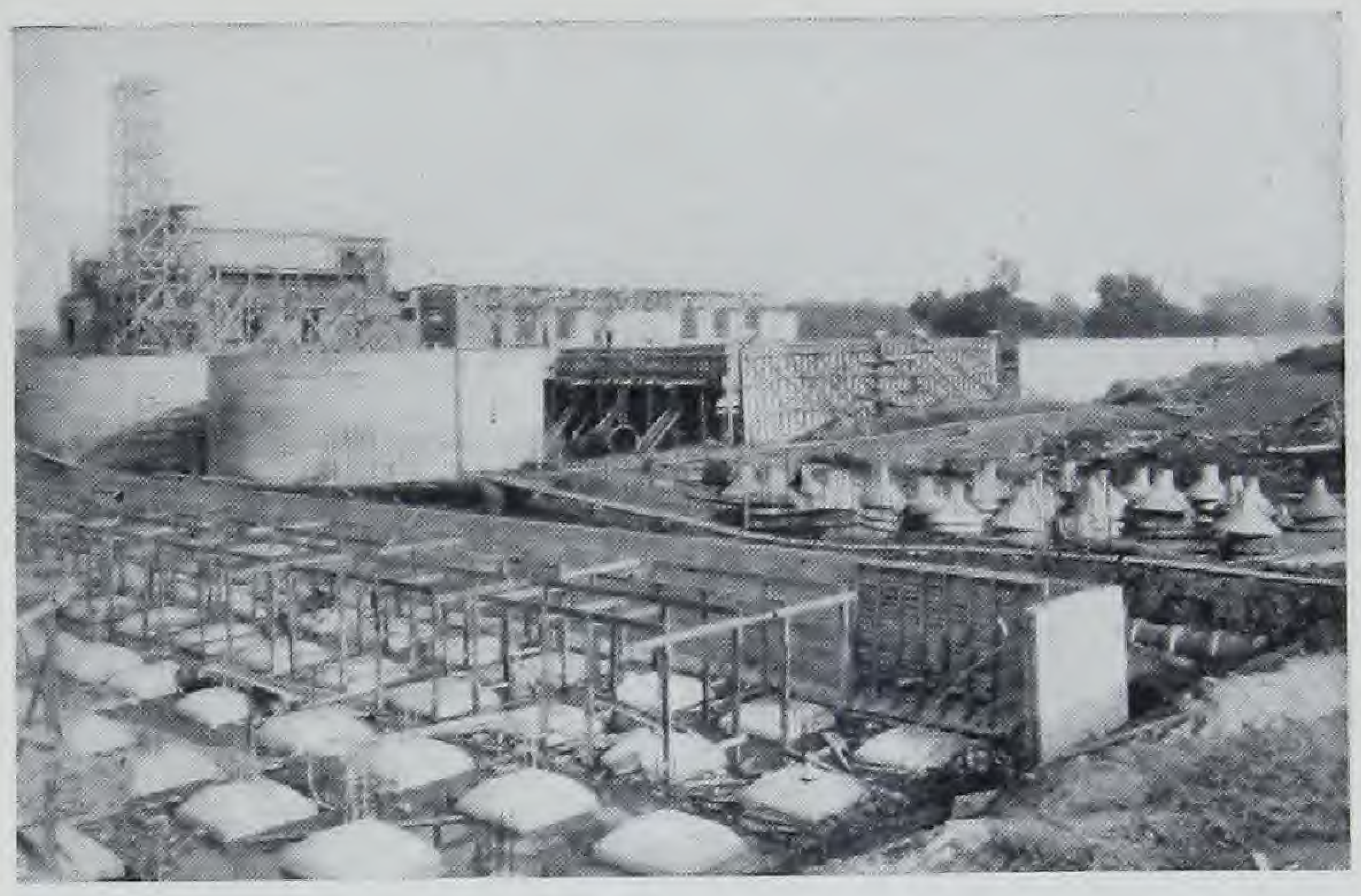


Fig. 8. Springfield (Illinois) Water Treatment Plant. Burns & McDonnell Engineering Co., Kansas City, Mo., Engineers. Cope & Fisher, Decatur, Ill., Contractors. 3% Celite in 1:2:4 Mix.

Bulking tests have been made by many engineers and laboratories. The usual method is illustrated by a test made by a large firm of engineers and contractors on the Pacific Coast. Forms were made of 2″x10″x16′ planks, stood on end so that the concrete could be poured in from the top. A 1:2½:3½ mix was used, with coarse washed sand and ¾″ stone. All materials were carefully measured in a cubic foot measuring box; 6.34 gals. of water were added to the dry mix and a column of concrete was secured—10 ft. 11 in. in height.

Fig. 9. Trenton (N. J.) Sewage Disposal Plant. Johnson & Watson, New York City, Consulting Engineers. J. P. White Co., Trenton, N. J., Contractors. On this job concrete was delivered 300 feet by chute from 105 foot tower. Celite eliminated the need for excess water.

In the next two batches the same amount of material and the same quantity of water

were used, the only change being the addition of 3½ lbs. of Celite. This mixture gave columns 11 ft. 6 in. in height, or an increase of 5.3% in the volume of concrete

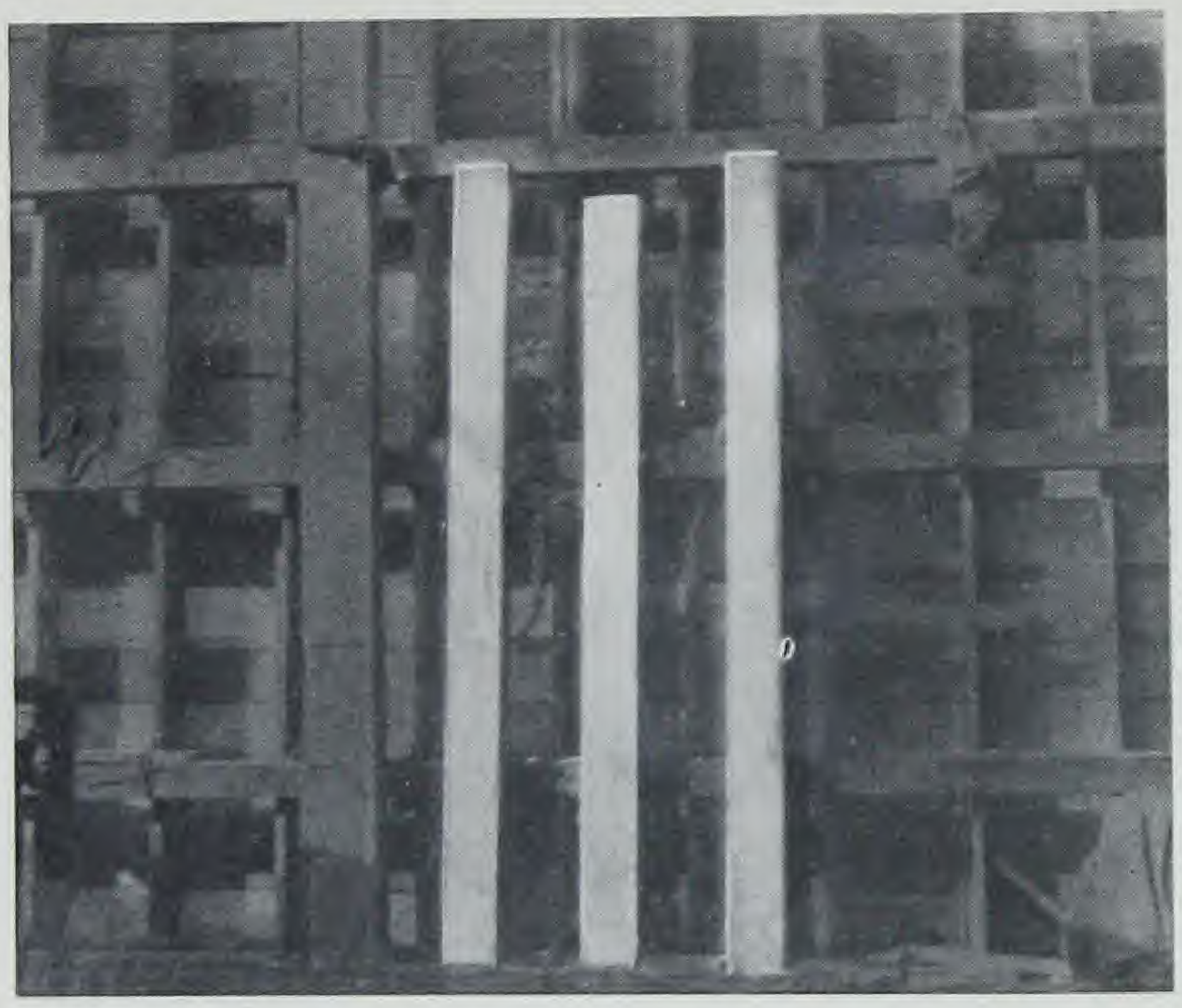


Fig. 10. Center Column Plain 1:2½:3½ Mix. Columns on either side same except 3½% Celite added, giving increased yield of 5.3%. Tests by McDonald & Kahn, Contractors, Los Angeles, Calif.

secured. Furthermore, the texture and apparent uniformity of the Celite concrete were considerably more satisfactory than that of the plain concrete.

In this case the increased amount of concrete in place was more than enough to offset the cost of the Celite used. The results of this test agree very closely with other tests conducted by numerous laboratories and engineering organizations and also with field tests made on a number of State paving projects. A test on 1:2:4 concrete, similar to the one described above, was made by the Robert W. Hunt Company, Chicago, Illinois. Screen tests were made on the materials used and all materials were carefully measured. Two columns of concrete were poured, one of plain 1:2:4 mix and the other containing 4% of Celite by weight of cement. The volume of concrete secured was 7.545 cu. ft. for the plain concrete and 8.007 cu. ft. for the concrete containing Celite, or an increased yield of 6.12%.

Bulking tests made on Delaware and North Carolina State Highway work are given in the following table:

1:2:4 Concrete Pavement

	Linear Feet Laid		*Relative Materials Used Bags of Cement Per Foot as Index*			*Additional Concrete due to bulking of Celite*
Project	*Plain or with hydrated lime*	*Celite concrete*	*Plain or with hydrated lime*	*Celite concrete*	*Amount of Celite used*	
Del.-A	11522	4024	2.21	2.08	4%	6.3%
Del.-B	5663	6675	2.115	2.00	3%	5.8%
Del.-C	7616	12405	1.81	1.73	3%	4.6%
Del.-D	12124	15953	1.85	1.76	3%	5.1%
N.C.-E	11040	9052	2.24	2.13	3%	5.2%
N.C.-F	2818	3893	2.18	2.08	3%	4.8%
Average			2.04	1.94	3%	5.2%

In addition to the increase in yield secured through the use of Celite as an admixture, the increase in workability naturally results in lower labor costs for placing the concrete and both of these advantages are of particular benefit to the contractor.

CELITE IS ADAPTED TO ALL CONCRETE WORK

Improved workability with its attendant advantages, in addition to increased watertightness and higher yield of finished concrete in place are all of vital importance in every class of concrete construction as well as in the manufacture of concrete products. Celite is used to secure better concrete at less cost on concrete work of every description.

Paving

Concrete used in road work seldom fails under direct compression. Direct impact is approached when the pavement is required to withstand the pounding of heavy traffic over

Fig. 11. Fire Wall—Olympic-Calpet Refining Co., Seattle, Wash. W. C. Houghteling, Engineer. Albertson, Cornell Bros. & Walsh, Contractors. 2% Celite in 1:6 Mix.

its surface. That a given static load is multiplied several times when transferred into an impact stress has been clearly shown in work carried on by the U. S. Bureau of

Public Roads. The effective slab thickness is the primary factor determining the resistance to impact and the ability to resist impact increases rapidly with increase in slab thickness.

The effective slab thickness is the net thickness of solid concrete. The presence of honeycombing reduces, by its equivalent thickness, the amount of solid pavement. Workable concrete of relatively dry consistency which flows into place with a minimum of manipulation will result in a concrete of maximum uniformity free from honeycombing. Such concrete attained by the use of Celite assures a pavement with the full effectiveness of its normal slab thickness and one which will have a maximum resistance to impact in service.

Where central mixing is employed, the advantages of using Celite are even more pronounced. In such cases the concrete must be hauled considerable distances and it has been practically impossible with ordinary concrete to dump the trucks satisfactorily and avoid extreme segregation in transit. By the use of Celite, concrete may be hauled for miles without segregation and the concrete can be dumped and placed with a minimum of manipulation. Celite has been the means of

Fig. 12. Laying plain concrete pavement, showing segregation which causes honeycombing and non-uniformity.

making central mixing a thoroughly practical operation.

Concrete containing Celite can be placed much more rapidly than plain concrete, resulting in a saving in labor. The illustrations in Figures 12 and 13 show clearly the ease with which concrete containing Celite can be placed, compared with plain concrete in pav-

Fig. 13. Laying concrete containing Celite. Showing uniform coating of matrix on coarse aggregate and absence of segregation.

ing construction. No lines of cleavage will be encountered between batches and the pavement is easily finished.

Bridges, Dams, Tunnels, Reservoirs, etc.

In the construction of bridges, dams, tunnels, subways, reservoirs, storage tanks, etc., the greater workability secured with Celite results in a concrete of maximum uniformity and strength. The higher degree of watertightness, due to greater uniformity and reduced void size, insures maximum resistance to water penetration and increases the life of the concrete considerably.

In massive types of construction it is possible by the use of Celite to increase the proportion of coarse aggregate, resulting in a concrete of higher density. This can be done through the use of Celite without running into difficulties with harsh working mixtures such as would normally result from such practice.

In tunnels an operation similar to that of central mixing becomes necessary and Celite aids greatly in securing satisfactory results. In one large tunnel on the Pacific Coast, the concrete had to be hauled approximately two miles from the mouth of the tunnel and in many cases could not be placed for twenty

or thirty minutes after leaving the mixer. Celite was used on this work and no difficulty

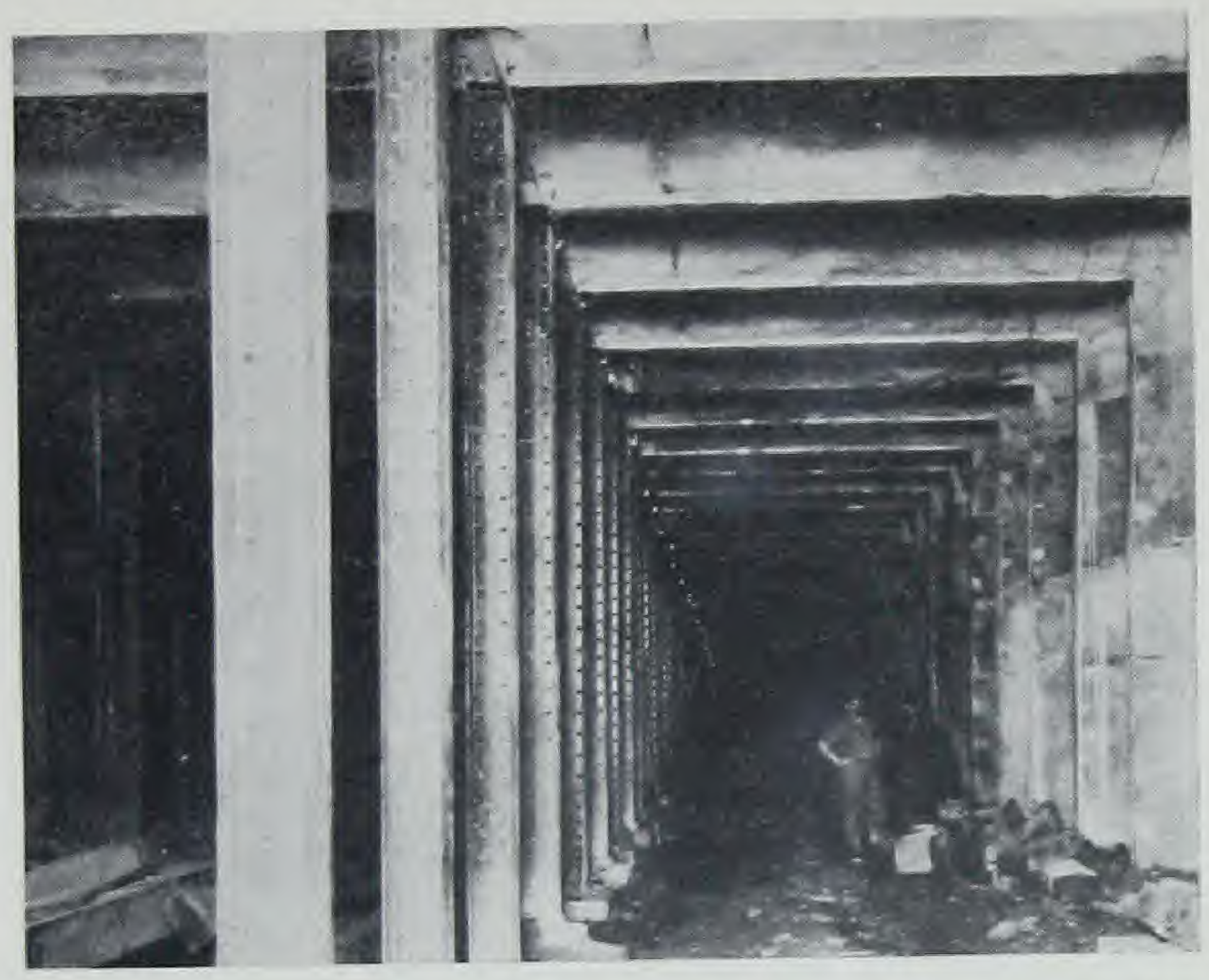


Fig. 14. Construction Work by Keystone State Construction Co., in Philadelphia Subway. 4% Celite in 1:2:4 Central Mixed Concrete.

was encountered due to segregation. The concrete dumped easily, was easily placed and set up with a finish of excellent texture. As this tunnel was to be used for carrying water, the increased water-tightness secured with Celite was an additional advantage of great importance.

Concrete Buildings

Celite has been used on a great many concrete buildings of various types throughout

Fig. 15. Sewage Disposal Plant at Louisburg, N. C. Tucker & Laxton, Inc., Contractors. 3% Celite Used.

the country. Not only are workability, uniformity, strength and water-tightness improved, but the finish on concrete containing Celite is of much finer texture than is ordinarily secured with plain concrete.

The greater workability assured by the use of Celite enables concrete to be placed in intricate forms to meet exacting requirements of architecture, with assurance that when the forms are removed the concrete will be found to have filled the forms completely, making patching unnecessary and finishing a simple matter. Large reinforced concrete buildings have been constructed with such excellent results that no patching of any kind was necessary after removal of forms.

In reinforced concrete construction and where structural steel is encased in concrete, a much better bond can be secured between steel and concrete, with consequent greater

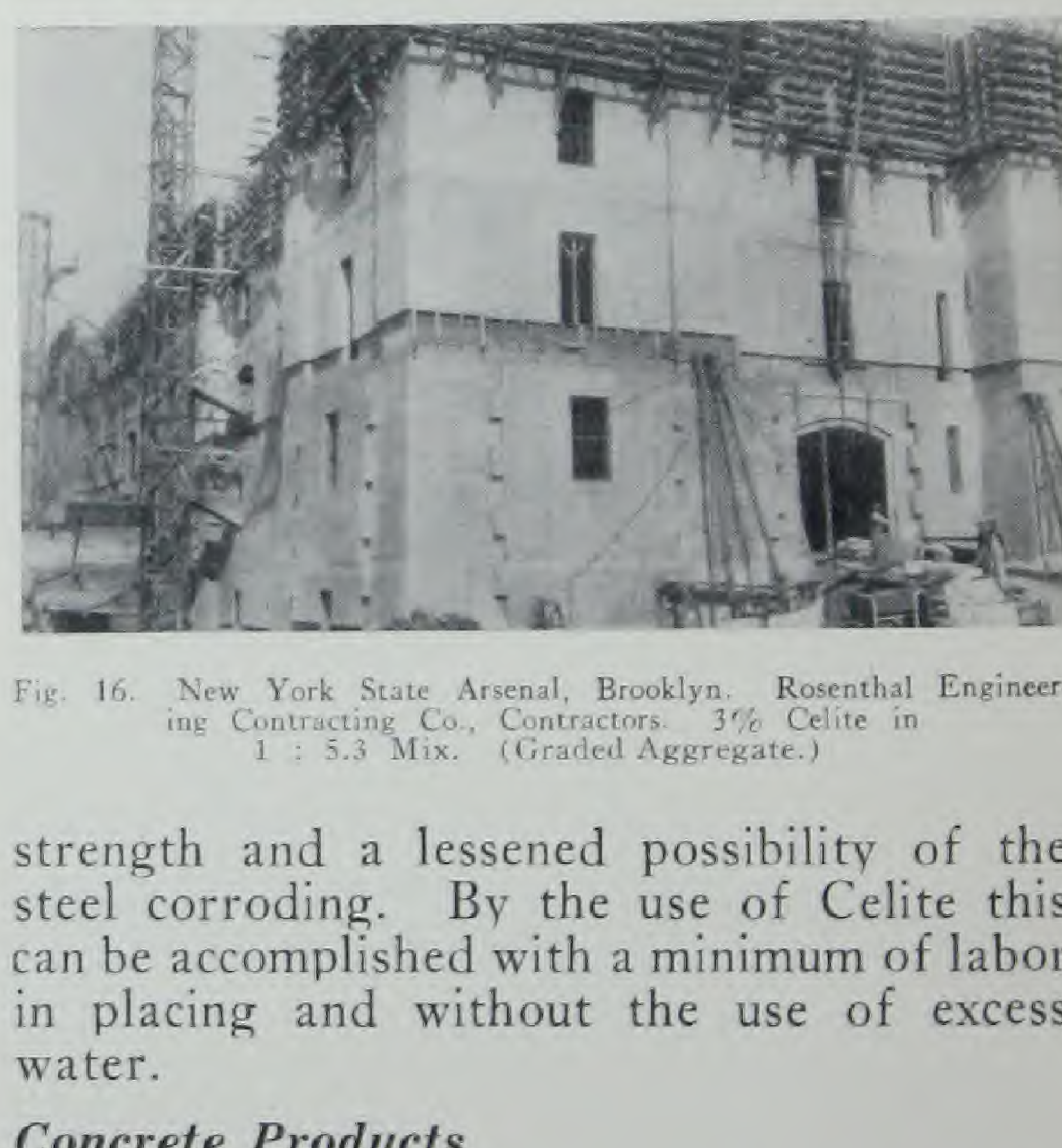


Fig. 16. New York State Arsenal, Brooklyn. Rosenthal Engineering Contracting Co., Contractors. 3% Celite in 1 : 5.3 Mix. (Graded Aggregate.)

strength and a lessened possibility of the steel corroding. By the use of Celite this can be accomplished with a minimum of labor in placing and without the use of excess water.

Concrete Products

In the making of all concrete products, the manufacturing operation can be facilitated and the strength and appearance of the finished product improved by the use of Celite as an admixture. Many manufacturers of concrete pipe, building block, etc., are using Celite in quantities of 3% to 4% of the cement content and making a better, more uniform product with an actual saving in manufacturing cost. In localities where the most economical coarse aggregates may result in harsh working mixtures, this difficulty is

readily overcome by the use of Celite as an admixture.

CONCRETE IN SEA WATER

The value of siliceous admixtures in combining with the free lime which is formed as concrete hardens, is particularly emphasized in cases where concrete structures may be subjected to the action of sea water as would prevail in the case of concrete piers, piles or jetties.

This factor is recognized clearly in the following statement by a competent group of civil engineers:[1]

> "Practically all investigators agree that the most active disintegrating element in sea water is magnesium sulphate; that ordinary Portland cement after setting leaves a residue of 15 to 30% of free lime; and that the magnesium sulphate combines with the free lime in the concrete and frequently leaves a deposit of sulphate crystals which occupy roughly 1.4 the volume occupied by the lime, resulting in an explosive effect.
>
> "If there be even a slight movement of the water in the body of the structure after the removal of the free lime, the tricalcium silicate, which is the most quickly formed product in the setting of the concrete, is broken down. Once this process is commenced it continues until the concrete is reduced to a disintegrated mass of sand and other aggregate.
>
> "One method of preventing this disintegration is by adding to the cement a finely ground silica having the necessary qualities and in a proper quantity such that on setting, the silica and the lime will form compounds insoluble in sulphate-bearing waters . . .
>
> "The addition of such silica to Portland cement or to lime not only results in the formation of compounds little affected by the attacks of sulphates, but it is also of considerable value in making the concrete more impervious."

Celite, being practically pure silica, is the most effective material which can be used in solving this problem. The increased physical water-tightness is an additional advantage of great importance.

Fig. 17. Making concrete pipe for City and County of Los Angeles. 2½% Celite in 1:2:4 Mix.

USE OF CELITE WITH CALCIUM CHLORIDE

When calcium chloride is used to hasten the setting of concrete, it simply means that there is included in the mix, one more ingredient which in itself is by far the most pronounced in its effect on the early strength, and whose efficiency depends largely on the uniformity of its distribution throughout the mass.

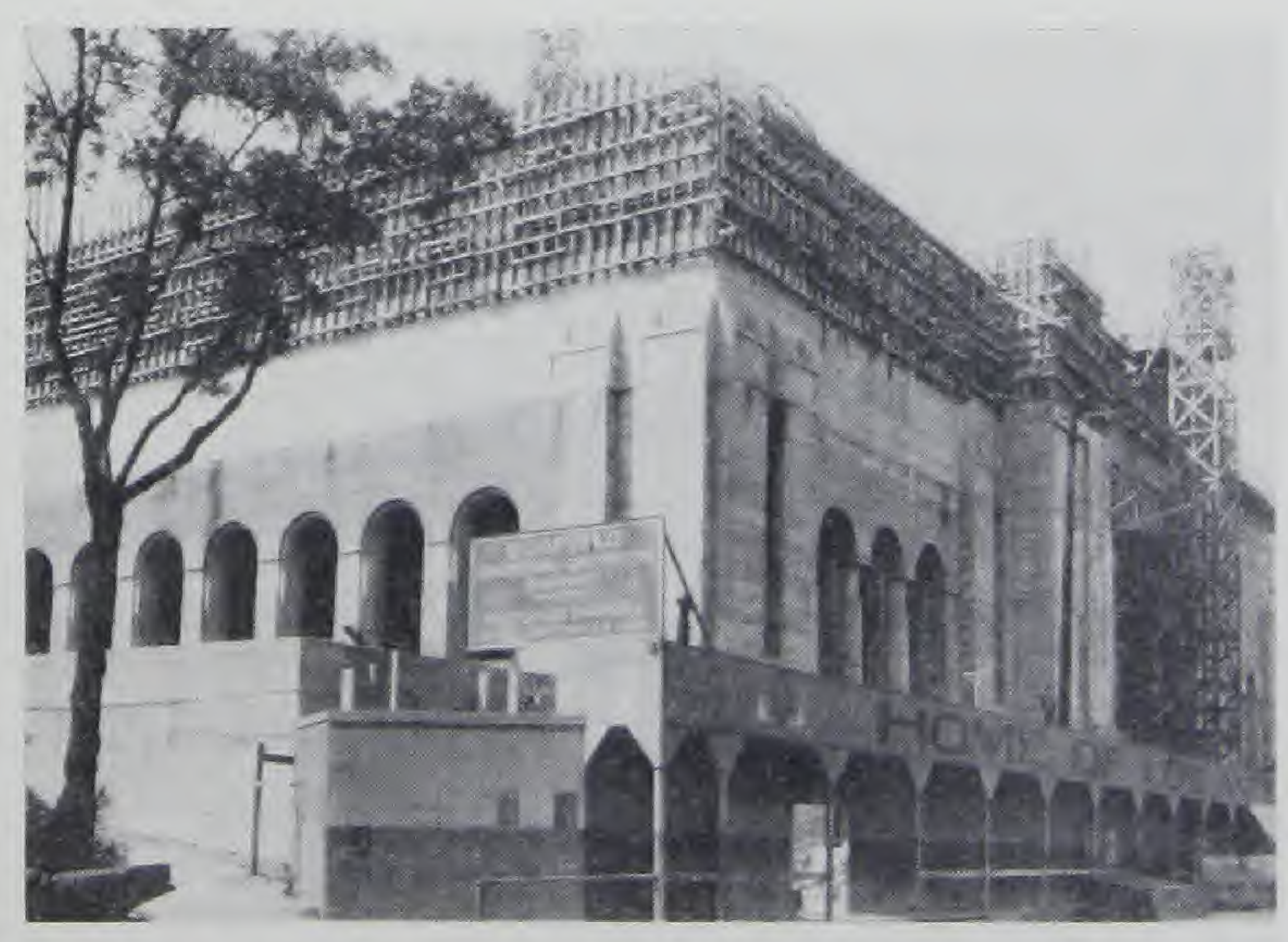


Fig. 18. Elks Club, Los Angeles, Calif., Curlett & Beelman, Architects. Scofield Engineering-Construction Co., Contractors. 3% Celite in 1:2½:3½ Mix.

The plastic properties imparted to the mix through the use of Celite are responsi-

1. From abstract of the report of the Committee on Marine Piling Investigation—A.S.C.E. 1924 Proceedings.

ble for a more uniform distribution of water throughout the mass and also for its being retained in its proper distribution during setting. As the calcium chloride is carried in solution with the water, this greater plasticity results in a more uniform action on the cement. The advantages of Celite are, therefore, emphasized in this case.

CELITE IN STUCCO AND PLASTER

Cement stucco for exterior work often contains as much as 10% of lime by weight of cement. The substitution of 5% of Celite in place of an equivalent amount of lime, causes the plaster to finish with sharper detail and produces a wall that will withstand weather without the softness, cracking and checking so objectionable in ordinary cement-lime stucco. Furthermore, the stucco will spread more easily, stretch farther and finish more quickly and smoothly.

When gypsum plaster has become practically dead or is working short, an easy spreading mortar equal to freshly calcined material can be secured by the addition of 5% of Celite by weight of the plaster.

Fig. 19. Harris & Frank Building, Los Angeles. Curlett & Beelman, Architects. J. V. McNeil Co., Contractors. 3% Celite in 1:2½:3½ Mix.

CELITE IN MORTAR MIXTURES

Lime mortars can be made stronger by the addition of 10 to 15% of Celite by weight of lime, as within certain limits Celite will combine with lime, forming a harder mortar. The stretching property of these mortars can also be increased in this way.

Portland cement mortar can be improved greatly by the addition of 5% of Celite by weight of cement. Celite holds the moisture within the mortar, insuring a better bond by allowing more time for the placing of the brick before the workability of the mortar has been destroyed.

SPECIFICATIONS:

Complete specifications covering siliceous admixtures and their use in concrete are given in Bulletin 317, sent on request.

Further specific information on the use of Celite will be gladly furnished on application to any of the company offices.

Fig. 20. Reservoir (1,750,000 bbl. capacity). General Petroleum Co., Watson, Calif., Robinson-Roberts Co., Redondo Beach, Calif., Contractors. 3% Celite in 1:2½:3½ Mix.

Printed in U.S.A.